**CEM 251 (Sections 101-104)**
**Midterm #2**
**June 25, 2010**

Name: ___________________________  
Section: _______

PID: ___________________________  
TA: ____________

This is a closed book and note examination. If boxes are provided for your answer, only what is written in the boxes will be graded. You have 50 minutes to complete the test.

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<th>M/W 10:20 – 11:10 AM</th>
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1. Name or draw the structures for the following molecular compounds including stereochemistry when possible. (2 pts each):

- ![Cyclic structure](image1.png)
- ![Alcohol structure](image2.png)
- (Z)-3-bromo-4-propyl-3-heptane
- 2,3,4-trimethyl-1-decene oxide
2. Rate the relative nucleophilicity from greatest to least (1-4, 1 being the most nucleophilic). (1 pt each):

\[ \text{Nucleophiles} \]

3. Rate the relative basicity from least to greatest (1-4, 1 being the least basic). (1 pt each):

\[ \text{Basics} \]

4. Label each C-C double bond as cis (C), trans (T), E, or Z. (1 pt each)

\[ \text{Double Bonds} \]
5. Draw each of the monochlorinated products of the following reaction (6 pts).

\[
\begin{array}{c}
\text{Cl}_2, \text{hv} \\
\end{array}
\]

6. Draw the monobromination products for the following reaction (6 pts).

\[
\begin{array}{c}
\text{NBS, hv} \\
\end{array}
\]

Bonus: Draw the two resonance hybrids that lead to the above products (4 pts).
7. Fill in the boxes with the appropriate reagents, products, and responses (2 pts each).

\[ \text{alkyne} \rightarrow \text{Br} \xrightarrow{\text{KOH}} \text{alkene} \rightarrow \text{most stable alkane} \xrightarrow{1. \text{O}_3, 2. \text{S(CH}_3)_2} \]

\[ \text{Show Stereochemistry} \]

\[ \text{Na, NH}_3 \rightarrow \text{OH} \xrightarrow{\text{H}_2\text{O}^+} \text{acid} \rightarrow \text{anion} \xrightarrow{\text{CrO}_3, \text{H}_2\text{SO}_4, \text{H}_2\text{C}} \text{product} \]

Bonus: Name this reaction.
8. Draw products of the following reactions after 1,2-alkyl or 1,2-hydride shifts. (2 pt each) Then, identify the type of 1,2-shift (1 pt each).

\[
\begin{align*}
\text{H}_2\text{SO}_4 & \quad \rightarrow \quad \text{H}_2\text{O} \\
\text{Br} & \quad \rightarrow \quad \text{HO} \\
\text{OH} & \quad \rightarrow \quad \text{ring expanded product}
\end{align*}
\]

9. Indicate the correct product or diethyl tartrate (DET) used in the reaction where necessary. (2 pts)

\[
\begin{align*}
\text{OH} & \quad \rightarrow \quad \text{Ti(OPr)₄} \quad \rightarrow \quad \text{BuOOG} \\
\text{OH} & \quad \rightarrow \quad \text{Ti(OPr)₄} \quad \rightarrow \quad \text{BuOOG} \\
\text{OH} & \quad \rightarrow \quad \text{Ti(OPr)₄} \quad \rightarrow \quad \text{BuOOG} \\
\end{align*}
\]
10. Fill in the boxes with the appropriate products (2 pts each) and indicate whether the reaction is addition, substitution, elimination, oxidation, or reduction. (1 pts each) Though a reaction may fit more than one classification, only put one.

\[
\begin{align*}
\text{1. LiAlH}_4 & \quad \text{2. H}_2\text{O}^+ \\
\text{Lindlar's cat.} & \\
\text{1. OsCl}_4 & \quad \text{2. Na}^+\text{HSO}_3^- \\
& \quad \text{H}_2\text{O} \\
\text{1. BH}_3 & \quad \text{2. NaOH} \\
& \quad \text{H}_2\text{O}_2 \quad \text{H}_2\text{O} \\
\text{HO} & \\
& \quad \text{H}_2\text{SO}_4 \\
\text{POCl}_3 &
\end{align*}
\]
11. Draw the mechanism for the following reaction (6 pts).
12. Devise a synthesis for the following molecule using the given starting material. (6 pts)

![Molecular structure](image)

**Bonus:** How many RMB are in the product? (2pts)